ACADIA NATIONAL PARK ITS FIELD OPERATIONAL TEST

EVALUATION PLAN

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Table of Contents

Page

Table of Contents (Continued)

Page

List of Tables

List of Figures

Executive Summary

This document presents the plan for evaluating technologies known as Intelligent Transportation Systems (ITS) that will be implemented in Acadia National Park and Mount Desert Island, Maine. Acadia National Park was selected as a site for an ITS Field Operational Test (FOT) through collaboration of the U.S. Department of Interior and the U.S. Department of Transportation. As in Acadia, many National Parks are experiencing severe transportation problems, which frustrates their dual mission of preserving natural and cultural resources while providing visitors with a meaningful and pleasant experience. Intelligent Transportation Systems may help provide solutions to some of these problems.

Battelle Memorial Institute was selected by U.S. DOT to conduct an independent evaluation of the efficacy of the ITS technologies at Acadia and to document the lessons offered by the FOT so that other National Parks or locations with similar transportation problems can learn from the experience. The plan contained in this report represents the second stage of a multi-stage process for conducting the evaluation. Based on the results of a strategy workshop at Acadia National Park on May 24, 2000 with representatives of stakeholder organizations, the evaluation plan was guided by priorities in six evaluation goal areas: customer satisfaction, mobility, safety, efficiency, productivity and economic vitality, and environment and energy. Hypotheses are presented on the expected impact from ITS in each goal area, and measurements are identified that can be used to test those hypotheses. Several approaches to collecting data will be used, including surveys, personal interviews, focus groups, system data from the ITS components, agency records, and direct observation.

The ITS system architecture for Acadia includes nine system components in three general areas: transit management, traffic management, and traveler information. A team led by SAIC was selected by U.S. DOT to work with local stakeholders to design and deploy the ITS components as an integrated system. The implementation schedule for the system calls for much, if not all, of the installations of ITS technologies planned for Acadia to be operational in time for the 2001 summer tourist season. Based on that schedule, the evaluation plan will proceed with baseline data data collection in 2000 so that post-deployment impacts can be measured with data collected in 2001.

ACADIA NATIONAL PARK ITS
FIELD OPERATIONAL TEST

EVALUATION PLAN

1.0 Evaluation of ITS at Acadia

U.S. Department of Transportation is sponsoring an independent evaluation of the Field Operational Test (FOT) of Intelligent Transportation Systems (ITS) at Acadia National Park. Based on the strategy defined in an earlier document, "Acadia National Park ITS Field Operational Test, Evaluation Strategic Plan,"[1] the plan for evaluation discussed in this report identifies the specific evaluation methods and how they will be used to implement the goals and objectives for assessing the impact of ITS technologies at Acadia. The first section of the document provides a brief discussion of the transportation problems at Acadia and the role of ITS in addressing those problems. Section 2 presents the ITS components being deployed as part of the FOT at Acadia National Park. Section 3 discusses the goals and objectives of the evaluation that emerged from the strategic plan, and Section 4 presents the technical approach proposed for measuring the impacts of ITS at Acadia. Section 5 summarizes the plan for managing the evaluation in terms of schedule and roles and responsibilities of the evaluation team.

1.1 Background on Acadia's Transportation Problems

Acadia National Park is part of the U.S. National Park System, which has as its dual mission the preservation of natural and cultural resources and providing visitors with a meaningful and pleasant experience. Acadia hosted 2.6 million recreation visits in 1999,[2] making it one of the most-visited National Parks in the peak summer months of July and August. Tourism dominates the regional economy, and the attraction of Acadia National Park is a major contributor to the tourism industry.

The popularity of Acadia National Park and the growth of tourism on Mount Desert Island are not without problems. During the peak tourist season, roadway congestion is the norm, and parking at trailheads and beaches has become increasingly difficult. Lengthy traffic delays and noise and air pollution often detract from the experience visitors have come to enjoy, and they also threaten the Park's natural and cultural resources.

To relieve traffic congestion, Acadia National Park has turned to public transportation as the preferred approach for both protecting the aesthetic and natural resources of parklands and providing a quality visitor experience. With support from public and private funding sources, in 1999 the Island Explorer bus service was launched to provide free transportation during the tourist season on Mount Desert Island. The success of the service in its first season led to a decision to expand the service for the 2000 summer season.

[1] Battelle Memorial Institute, "Acadia National Park ITS Field Operational Test: Evaluation Strategic Plan." Prepared for U.S. Department of Transportation, ITS Joint Program Office, July 2000.
[2] National Park Service web page: www2.nature.nps.gov/npstats/

1.2 ITS as Potential Solution to Transportation Problems at National Parks

The U.S. Department of Interior (USDOI), the parent organization for the National Park Service, and the U.S. Department of Transportation are collaborating on the use of technology, including intelligent transportation systems (ITS), to address transportation problems in National Parks. Acadia was chosen for a Field Operational Test of ITS to assess the effectiveness of ITS in helping to solve those problems. SAIC was selected by U.S. DOT to work with the National Park Service and local stakeholders on Mount Desert Island to design and deploy the ITS FOT. U.S. DOT selected Battelle to conduct an independent evaluation of the FOT to assess the benefits from the ITS technologies and identify lessons learned that might be applied to other National Parks.

2.0 System Description

The Intelligent Transportation Systems to de deployed at Acadia integrate nine different components, which support the region's needs for public transportation management, travel and traffic management, and emergency management. The components are interrelated and depicted in Figure 1, and Table 1 presents additional details on the individual components. Only the two-way voice communication system for the Island Explorer bus service is planned for operation during year 2000, with the remainder of the components scheduled to be operational in the 2001 tourist season.

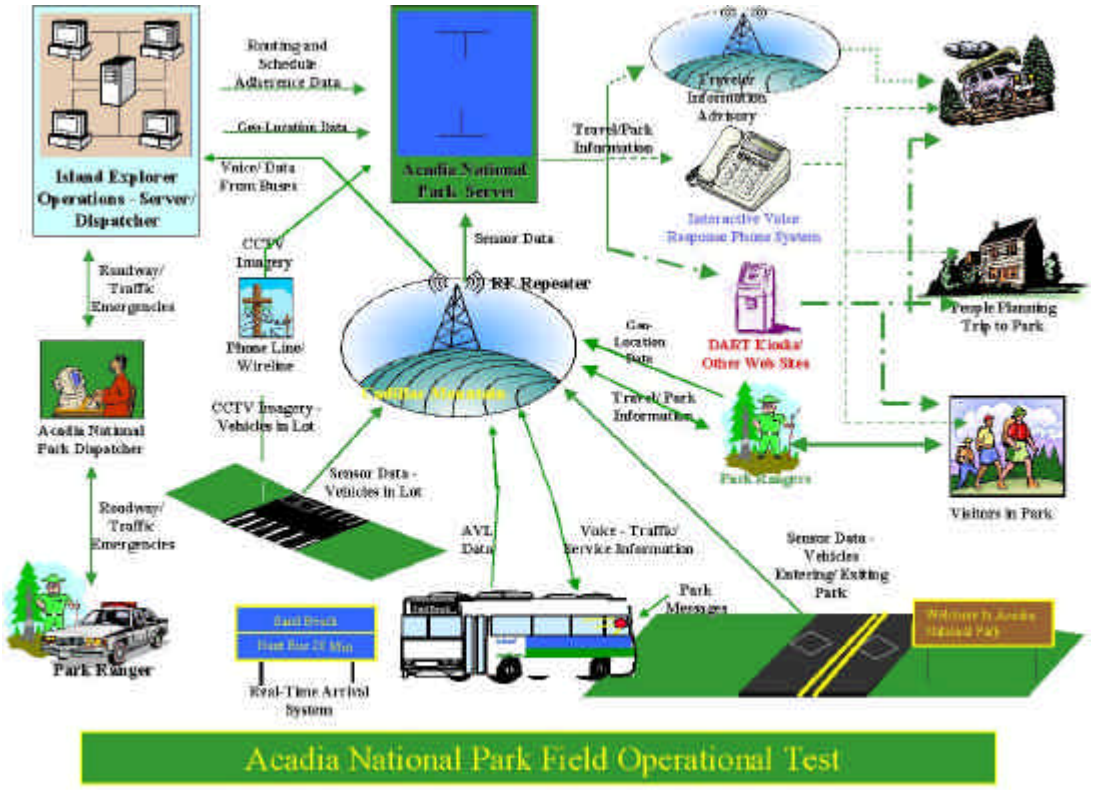

Figure 1. System Architecture for ITS FOT at Acadia National Park

Table 1. ITS System Components

System Component	Functional Requirements	System Elements	Needs Addressed
Island Explorer Two-way Voice Communications	Transmit and receive to/from/between vehicles and dispatch center	Transceivers; vehicle and base station Repeater to amplify signal	Improved efficiency Improved safety Real time traffic information for park staff, reduce crush load conditions, incident detection
Automatic Vehicle Location for Island Explorer	Compute and transmit vehicle location Integrate vehicle locations with arrival signs, display current vehicle locations, integrated into annunciator	Vehicle transmitter TCP/IP Network Connectivity, GPS Transceiver, GIS Applications, Travel Time Applications	Improved efficiency and performance Decreased use of POV's Improved safety Improved Response Real time updates Increase ridership
Arrival Sign for Island Explorer	Transmit location Compute arrivals Transmit to arrival signs	Display sign Software, Wireless/wireline Communications	Provide real-time informationIncrease ridership
Automated Annunciator for Island Explorer	Determine location Automatically play next-stop and other pertinent announcements	Vehicle annunciator	Improve efficiency Reduce delays Increase safety Improve visitor experience
Automated Passenger Counting for Island Explorer	Automatic counts of boardings/alightings Store information	Sensor to perform counts Data storage	Increase efficiency Improve planning Increase data options Reduce vehicle crush loads
Parking Lot Monitoring	Record number of vehicles entering and exiting, provide slow scan video of parking area, transmit data, display video, store data from vehicle counts	Counting sensor Video camera Display monitor Wireless/wireline communications TCP/IP network connectivity	Decreased use of POV's Provide planning data Information for Rangers Decreased Response times
Automatic Ranger/Vehicle Geo-Location	Remotely determine location of rangers, transmit same to server, display locations on map	Transmitting unit GPS Transceiver Repeater for signal GPS/GIS Software	Information for Rangers Exact locations of Rangers Decreased response times Improved visitor safety, security
Entrance Traffic Volume Recorder	Record and transmit number of vehicles entering and exiting, store data	Counting sensor Transmission unit	Count vehicles Provide Planning Data Decrease use of POV's
Traveler Information System	Collect and integrate data, disseminate data to appropriate audience	Interactive telephone messaging system, web pages, vehicle sensors	Increase availability and display options of information, Decrease use of POV's, Improve visitor experience

3.0 Evaluation Goals and Measures

The evaluation plan is the second step in a five-step evaluation process, and it is based on the initial step of developing a strategy for evaluation. For the Acadia National Park ITS FOT, a workshop consisting of the Battelle Team and project stakeholders was held on May 18, 2000, to provide input to the evaluation strategic plan published in July 2000. From that strategy an evaluation plan is being prepared, and will be issued in two parts: the overall plan (this document) and detailed test plans (future documents). The overall evaluation plan lays out what aspects of the ITS project will be assessed, how, when, and the methods to be used for collecting data. For each evaluation test to be conducted, a detailed test plan will be developed and will include the specific protocols (e.g., survey questionnaire) and details on responsibilities and resources

Steps three through five of the evaluation process involve data collection, analysis, and reporting. Through this multi-step, systematic process of evaluation, the result will be the measurement and documentation of the test of ITS effectiveness in addressing transportation problems at Acadia National Park, information that can be applied to other similar settings.

3.1 Evaluation Strategy for Acadia ITS FOT

The strategic plan set priorities for focusing evaluation resources. Five potential evaluation goals for ITS deployments in rural areas such as Acadia National Park were examined. These were:

- Safety
- Mobility
- Efficiency
- Productivity and economic vitality
- Energy and environment
- Customer satisfaction

There was considerable agreement among the May 18 workshop participants that customer satisfaction and mobility were higher in priority than other goals. However, the other evaluation goal areas also hold some level of importance among the stakeholder organizations. Thus, the evaluation plan will place greatest emphasis on ensuring that impacts of ITS on customer satisfaction and mobility are addressed, but the plan will also examine other types of impacts to the extent possible with available resources.

Another important element of the evaluation strategy relates to the collection of baseline data that reflect conditions prior to ITS deployment. Reuse of already-collected data will serve as baseline data whenever feasible so that evaluation resources can be applied where they will have the greatest incremental value. For example, an initial screening of available data sources indicates that several existing surveys of Acadia visitors and users of the Island Explorer can serve as baseline data for the customer satisfaction part of the evaluation. However, in other goal areas for evaluation not all of the desired measures can be supported by existing data.

3.2 Evaluation Measures and Hypotheses

In any evaluation the potential range of measurements is likely to be large. Collecting all possible data can be expensive and time-consuming, and, therefore, focusing the evaluation on measures of the greatest importance will be the most practical and useful approach. A few good measures (FGM) in each of the

evaluation goal areas have been identified and are so named because they collectively capture the key impacts of ITS at Acadia National Park and Mount Desert Island. However, for some of the few good measures quantitative assessment may be difficult or the data cost-prohibitive to collect. For those cases, surrogate measures are useful substitutes. For example, obtaining the self-reported percentage of trips taken on the Island Explorer will be more feasible to collect than trying to directly monitor actual trip making by a visitor. Tables 2 through 6 present the FGMs and surrogate measures by goal area and the data collection method or source to be used.

Using the FGMs and their surrogates the objectives of the evaluation can be translated into hypothesized effects of ITS at Acadia. For example, as shown in Table 2 for the goal of customer satisfaction, one objective is to enhance the visitor's experience through greater reliance on the Island Explorer for travel and less use of the visitor's private vehicle. It is expected that ITS technologies will contribute to that positive experience by informing visitors about the Island Explorer prior to their visit (pre-trip information) and, once on the island, by providing the visitor with the waiting time for the next bus at each bus stop (real-time arrival information). The hypotheses presented in Tables 2-7 provide a statement of anticipated effects of ITS that can be tested using the data collected during the evaluation process.

Table 2. Evaluation Goal: Customer Satisfaction

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To provide a more positive visitor experience through greater reliance on the IE for travel	Pre-trip traveler information services (TIS) will divert visitors from using POV's and to using IE	• Awareness and use of TIS • Travel mode choice • Benefits of TIS	• How became aware of (TIS) • Modes used for trip-making • Self-reported benefits of TIS	• Survey of IE users and non-users • Web log analysis of TIS website
	Real-time arrival information on next IE bus will increase visitors' willingness to use transit	• Awareness of real-time arrival information • Travel mode choice • Benefits of real-time arrival information	• How became aware of real-time arrival information • Mode of travel used • Self-reported benefits of real-time arrival information	Survey of IE users and non-users
	Real-time information on parking lot conditions will increase visitors' willingness to use transit	• Awareness of real-time information on parking • Travel mode choice • Benefits of real-time information on parking	• How became aware of real-time parking lot conditions • Mode of travel used • Self-reported benefits of real-time information on parking	Survey of IE users and non-users
To provide a more positive visitor experience through information on parking availability	Real-time information on parking lot conditions will increase visitors' ability to plan accordingly and to fulfill experience preferences	• Awareness of real-time arrival information • Travel mode choice • Benefits of real-time parking lot information	• How became aware of parking lot conditions • Mode of travel used • Self-reported benefits of having parking lot information	Survey of IE users and non-users
To provide a more positive visitor experience through efficient service	Tourists who use ITS feel less stress and worry due to service operations	• Number and nature of IE delays or denied riders • Benefits of ITS-improved IE and ANP services	• Perceptions of tourists who are aware of and use ITS services versus the perceptions of those who do not use ITS	Survey of IE users and non-users

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To provide useful and timely information for the Transportation Provider	ITS technologies will have positive benefits/effects on IE driver jobs, IE operations, and interagency relationships	• Transportation provider satisfactions with ITS technologies	• Perceived benefits of different ITS technologies with scheduling personnel and bus routes, planning, and response to emergencies	Interviews with IE, ANP, emergency personnel

Table 3. Evaluation Goal: Mobility

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To increase visitor's ability to access desired destinations and activities	Pre-trip traveler information services (TIS) will cause visitors to view IE as the most reliable and easy means to experience ANP/MDI.	• Awareness and use of TIS • Ease of travel • Destinations and activities	• How became aware of (TIS) • Modes used for trip-making • Perceived time and comfort of trip-making • Number and types of destinations • Number and types of activities	Survey of IE users and non-users
	Tourists who use TIS are more aware of travel options than those who do not use TIS	• Knowledge of travel options • Awareness and use of TIS	• Mode of travel used • Actual and perceived availability of travel option information	Survey of IE users and non-users
	Tourists use alternate routes or travel modes due to TIS	• Knowledge of travel options • Awareness and use of TIS	• Mode of travel used • Self-reported benefits of having parking lot information and IE information	Survey of IE users and non-users
	Tourists perceive that they have increased access as a result of their use of TIS	• Knowledge of travel options • Awareness and use of TIS	• Mode of travel used • Self-reported benefits of having parking lot information and IE information	Survey of IE users and non-users
	Tourists who use TIS perceive fewer problems with congestion and parking that might prohibit them from visiting certain destinations and activities	• Awareness and use of TIS • Knowledge of travel option	• Mode of travel used • Perceptions of tourists who are aware of and use TIS regarding the problems of congestion and the number of types of destination and activities	Survey of IE users and non-users

Table 4. Evaluation Goal: Productivity and Economic Vitality

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To provide a more positive visitor experience and increased visitation	ITS users stay longer than non-ITS users	• Number of visitors • Awareness of alternative attractions and activities	• Duration of stay • Number and types of destinations • Number and types of activities	• Survey of tourism businesses • Survey of IE users and non-users
To reduce or optimize operating budget of IE	Better real-time data will allow IE management to react to dynamic changes	IE costs by service measures	• IE staff overtime • O&M costs • Number of passengers, trips, service hours	• IE dispatch and driver records, • IE corporate records
To increase IE productivity	ITS will provide better operating information to enable better scheduling	On-time performance	• On-time arrivals and departures • Number of missed runs • Missed connections	IE dispatch and driver records
To increase economic contribution to MDI and ANP	ITS attracts visitors and enables higher revenue capture during stay	Tourism revenues	• Sales Tax Receipts • Duration of visitor stay • Visitor expenditures • Number of visitors	• Maine DOR • Interview with MDI tourist businesses
To maximize ANP revenue	ITS will provide better information will ensure that visitors pay Park fees and make contributions	Gate receipts and donations	• Park fees paid • Donations collected	ANP financial records
Attract carless tourist segment	Tourists arriving without cars will be attracted by ITS-enabled mobility	Tourist without cars	• Business owners hosting carless tourists • Self-reported carless tourists	• IE user survey • Survey of business owners

Table 5. Evaluation Goal: Efficiency

Objective	Hypothesis	Few Good Measures	Measures/ Surrogate Measures	Data Collection Method/Source
To increase the number of customers served	ITS provides better operating information, which allows for more efficient deployment of resources	• ANP throughput or effective capacity • IE throughput or effective capacity	• Number of visitors • Management of ranger incident response • Number of buses on routes • Dispatcher efficiency • IE schedule adherence • Number of passengers; denied riders	• ANP logs • IE dispatcher information • IE driver reports
To distribute the demand on ANP resources more evenly	Better information availability allows for visitor pre- and on-trip planning	Increase in throughput or effective capacity	• Number of stops at visitor centers • Crush loads on IE • Reduction in standing riders • Decrease in illegally parked cars • Car counts • Parking lot closures	• ANP logs • Driver reports • Maine DOT • ANP records • Battelle Team sample of illegal parking

Table 6. Evaluation Goal: Energy and Environment

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To reduce emissions from motor vehicles on Mount Desert Island	ITS-improved IE service will result in fewer trips by private vehicle and a consequent improvement in air quality	• Level of emissions	• Number of IE riders • Number of bicycles carried on IE • Modeled estimates of key emissions (CO, NOx, and HC) • Number of vehicles entering ANP; entering MDI	• MeDEP records • IE driver logs and automatic passenger counts • MeDEP emission model • MeDOT traffic counts • ANP traffic counts
To provide a more positive experience for visitors through enhanced aesthetics of Acadia National Park	ITS-improved IE service will result in fewer vehicles parked on ANP roads	• Illegally parked cars • Traffic on Park roads • Visitor perception of traffic impact on environment	• Counts of illegally parked cars in ANP • Counts of vehicles in ANP • Visitor perception of impact on environment	• Battelle Team sample of illegal parking • ANP traffic counts • IE user survey • Survey of IE non-users
	Visitors hearing environmental messages on IE annunciator will exhibit greater Park-appropriate behavior	• Understanding of ANP mission and values	• Visitor perception of ANP mission and values	• Survey of IE users and non-users

Table 7. Evaluation Goal: Safety

Objective	Hypothesis	Few Good Measures	Measures/Surrogate Measures	Data Collection Method/Source
To improve emergency response time within ANP and MDI	ITS will provide more timely information about incidents to emergency personnel enabling faster response	• Emergency response time	• Perception of improvements in minutes of response time	• Interviews with emergency personnel
To increase transportation safety in ANP and MDI	ITS will reduce vehicular traffic on roads thereby reducing the number of accidents	• Number of accidents	• Number of motor vehicle accidents by location	• MeDOT records
	ITS will reduce hazardous conditions by better management of transportation resources	• Parking conditions • IE load conditions	• Number of illegally parked cars in ANP • Number of passengers on IE buses • Number of IE runs	• Battelle Team sample of illegal parking • IE driver logs • IE records • Interviews with ANP and IE staff

4.0 Technical Approach

The technical approach for evaluating the impacts of ITS technologies being deployed in the Acadia National Park ITS FOT consists of several techniques for data gathering and analysis. The principal data collection methods to be used in the evaluation are:

- Surveys
- Personal interviews
- Focus groups
- System-generated data
- Agency records
- Direct observation

The following sections present further details on these methods as they will be implemented in the evaluation.

4.1 Surveys

A key component to the evaluation will be surveys to collect information from end-users of ITS technologies. Intercept surveys will be used to obtain information from visitors, and, mail surveys will be used to collect information from local businesses in the Mt. Desert Island area. Section 4.1.1 discusses the overall sampling design for the different sample populations. Section 4.1.2 contains a discussion on questionnaire development and links to the existing survey baseline data for detection of an effect of ITS technologies. Section 4.1.3 describes the survey operations and procedures. Section 4.1.4 discusses a variety of tools that will be used to analyze the survey data. Finally, section 4.1.5 describes the organization and responsibilities of the survey evaluation team.

4.1.1 Sampling Design

Information will be collected from tourists and local users of ITS technologies and the Island Explorer bus. The universe for this sample will be adults (over 18) using the Island Explorer bus during the scheduled season of operation and visitors at another site, such as the ANP Visitor Center. Table 8 summarizes the visitor surveys planned for the 2001 season. Details on the surveys are presented in this and the following two sections.

Table 8. Visitor Surveys Planned for 2001 Tourist Season

Visitor surveys	Screening questionnaire to determine ITS users	Completing main questionnaire	
Tourist ITS users and non-users	1,600 tourist contacts	800 total	400 ITS users
			400 non-users
Island Explorer bus users		800 bus users	

Field workers will sample bus users in a systematic fashion using multi-stage cluster sampling design. The primary sampling unit would actually be blocks of time (essentially individuals on a certain bus route during that block of time). Before the blocks of time would be selected, a stratification scheme would be

employed to define weekend clusters (Friday through Sunday) and weekday clusters (Monday through Thursday). The first stage cluster sample would then draw days from each strata per week of sampling. This will be two weekend and three weekday days chosen randomly from the possible days for each week. In a month use period this would be 20 total days, 8 days of weekends and 12 days of weekdays. The second stage of this sampling procedure would be to select bus routes. For each day, one shuttle route would be chosen randomly from the possible 7 Island Explorer routes. The third stage would be time shifts for sampling. The likely clusters of time to be randomly assigned to each individual sampling locations on a particular day would be two of three 4-hour time blocks out of a 12 hour sample day. The fourth stage would be to select every n^{th} individual who boards the Island Explorer bus.

Information will be collected from tourists who are users of ITS technologies but may or may not utilize the Island Explorer bus services. This sample of users will come from locations such at the visitor center in the Park or the village green in Bar Harbor where ITS technologies are installed such as parking lot video monitors. Field workers will sample tourists in a systematic fashion as described above using a multi-stage cluster sampling design. The second stage of the multi-stage cluster sampling design would involve specified locations with ITS technologies such as the visitor center, hotel, and village green rather than bus routes. Information will be collected from tourists using two different survey instruments: a screening instrument (screening questionnaires) and a more extensive questionnaire (main questionnaire). The screening questionnaire to determine if they are aware and used ITS will be short (about the size of a 3"x 5" index card), interviewer administered, and completed by a large portion of the population. The main questionnaire will be self-administered, will collect more information (both sides of one 8 ½" by 11" card-stock sheet), but will be given to a subset of tourists. Everyone who indicates that they are aware of and have used ITS will be asked to complete a main questionnaire. The screening questionnaire will allow the evaluation team to sample more efficiently based on usage of ITS, as there are likely to be fewer visitors who are aware of and used the ITS technologies than the unaware/non-user group. Once an ITS user is identified and has completed a main questionnaire, the next available visitor who did not use ITS will be asked to complete a main questionnaire.

In both data collection efforts described above, information from users of ITS technologies will be collected using an "intercept" approach. Information will be collected by intercepting users as they ride the Island Explorer bus or exit a pre-specified location such as a visitor center. This approach will be used, over other common approaches such as mail or callback surveys, because it will yield the most reliable data (recall and specific behaviors to the different ITS technologies).

In addition to collecting information from direct users of ITS technologies, a survey will be administered to collect information from indirect users such as Mount Desert Island and regional businesses. A sample of businesses will come from the Chamber of Commerce for the towns located on Mount Desert Island area and the Office of Tourism. Owners of the businesses who volunteer to participate in the study will receive a self-administered questionnaire in the mail that they are to return in a pre-paid self-addressed envelope. A mail survey rather than other approaches will be used to collect information at their earliest convenience because owners have extremely busy and varied hours during the summer and early fall season. Following this approach there would typically be a mailing of information, a postcard reminder/ thank you, and as many as two follow-up mailings of the questionnaire and appropriate cover letter.

4.1.2 Questionnaire Development

All survey instruments (questionnaires) will be designed to ensure easy administration and accurate data collection. In particular, they will include sufficient number of questions but will be compact enough to

be easily completed in a relatively short period of time. During the development phase, several steps will be taken to construct the questionnaire:

1) Feedback from stakeholders and site observations will influence question design and facilitate decisions on the balance of subject matter in the instrument.
2) Existing data sources will be examined to determine feasibility and utility of including identical questions for comparison to earlier studies.
3) Qualitative interviews will be conducted with a sample of Mount Desert Island regional businesses in the fall of 2000 to collect baseline data related to the impact of the bus system. This information will be integrated into a detailed mail questionnaire evaluation of ITS in the late summer/early fall 2001.
4) A draft of all survey questionnaires will be pre-tested for ease of understanding and time of completion.

While specific wording of the survey questions is not yet known, the survey format and many subject areas are known. In general, the questions will focus on what is essential for the evaluation process, and will include questions to measure perceptions of mobility, access, experiences with congestion, items which describe the respondent's trip, awareness of and visitation to alternative attractions, awareness and use of ITS, demographics, and other characteristics. Question areas will include most of those presented in Table 9 and perhaps others determined after initial qualitative interviews and site visits.

As a practical matter, however, the number of items will have to be limited, and the total number of items may have to be either reduced from those shown in the following table, or spread between two "interlocked" surveys. The latter approach is appropriate when the sample is large and the number of questions has to be large as well; otherwise, the respondents would be unlikely to complete a self-administered survey in the midst of a vacation.

In such cases, two questionnaires can be used and the sample split. Each questionnaire would then carry a core of questions concerning awareness and use of ITS travel patterns. Other items would be divided between the two alternative survey forms.

4.1.3 Survey Operations

Questionnaire information will be collected during the late summer (August 1st through September 3rd) by two interviewers. Interviewers will be university students who will be hired and trained expressly for this study. The data collection teams will be supervised by a full-time staff member. The first interviewer will collect questionnaire information from Island Explorer users for approximately eight hours per day. It is anticipated the interviewer can contact approximately 5 ITS users per hour who would be willing to fill out the detailed questionnaire. Thus, approximately 800 Island Explorer users will complete a main questionnaire (1 interviewer * 5 Island Explorer bus users per hour * 8 hours per day * 20 days). The second interviewer will collect questionnaire information from users and non-users of ITS at other locations to be determined such as the visitor center. It is anticipated the interviewer will be able to screen approximately 10 tourists per hour and that one in four of the persons screened would have used ITS during pre-trip planning or at some time during their visit and would be willing to fill out the more detailed questionnaire. Thus, approximately 1,600 will be screened (1 interviewer * 10 tourists per hour * 8 hours per day * 20 days), and the main questionnaire will be completed by 400 ITS users and 400 non-users.

Table 9. Question Areas for the Visitor Questionnaire

Overall Question Area	Information to be Collected
Information sources	# Planning this trip, non-ITS information sources used (e.g., travel agent, AAA) # Use of/familiarity with/comfort with electronic data sources
ITS	# Level of awareness of specific ITS sources of information (parking lot monitor, real-time arrival sign for Island Explorer bus, automated annunciator for Island Explorer bus, traveler information system) # Frequency of accessing each of these sources # Actual use of ITS travel information in reaching the FOT area # Actual use of ITS travel information within the FOT area # Information desired, but not available
Overall Vacation Trip Characteristics	# Mode of travel # Origin/Destination # Hotel or other accommodation # Duration of stay (nights/days) # Number in party and ages # Purpose of travel (recreation, worker) # Previous visits to same site (number, when)
Local Travel And Visiting Characteristics	# Modal choice (drive/park and ride bus, bike, and other) # Flexibility of local travel plans - can bus routes, choice of recreation opportunities, and other choices be shifted in response to new information? # Number and types of destinations # Number and types of activities # Perceived benefits of TIS
Satisfaction (if previous visit was made, comparison of present visit will be asked)	# With information on how to get around on Mount Desert Island without a car for visitors before they leave home # With the real-time bus location information at selected Island Explorer stops # With next-stop and other information on-board the Island Explorer buses # With the real-time parking availability information for key destinations # With access to more locations and diverse recreation opportunities # With congestion/ lack of congestion # Intent to return
Demographics	# Age # Income # Education # Region of country # Gender

Information will be solicited in a manner that will be easy for respondents to answer, using circles, checkmarks, and some very short answers, all of which will be directly coded to machine readable form. When the respondents are contacted in the field or through the mail they will be asked to participate in the study. They will be told that participation is completely voluntary and that all responses they make will be confidential.

Prior to each data collection period, the interviewers will undergo a half-day training session where they will be trained on basic data collection techniques that emphasize the need for accuracy and attention to detail, as well as the necessity for legible and complete recording of data. The training will also include an explanation of the specific aims of this project along with question-by question specification for each item in the survey instrument.

Structured group role-playing will be used to ensure that each interviewer is comfortable with the data collection procedures. Specific training in methods to prevent refusals and to persuade reluctant subjects will be provided. Training will continue throughout the data collection process. Data collectors will be given feedback by supervisory staff on errors and how to correct them. During data collection, data collection staff will be required to conduct their activities in the manner prescribed at training.

The self-administered, mailback questionnaire will be sent to a sample of Mount Desert Island businesses that agree to receive and complete the survey. Two specific samples will be targeted: 1) businesses that permit Island Explorer bus stops at their location as well as 2) other local and regional businesses. The initial mailing will include a questionnaire with a cover letter and postage-paid business reply envelope. One week after the first mailing, a postcard reminder/thank you will be sent to everyone. Three weeks after the initial mailing, a follow-up mailing will be sent to those who do not respond. Another questionnaire and postage-paid business reply envelope will be included. Finally, a second follow-up mailing will be sent to those who still have not responded after 7 weeks.

4.1.4 Survey Data Analyses

A variety of tools will be used to analyze the survey data. The analysis of the questionnaire data will focus on answering the following questions: Are tourists, residents, and local businesses aware of the ITS? Do they use the information? How do the systems change the behavior of the tourists? How valuable is the information to the tourists? Where do travelers prefer to get information? What type of information do they prefer? Does this technology improve the experience of the tourist? The analysis will include, at a minimum, cross-tabulations of survey results along with tests to assess significance of key statistical measures. Other more sophisticated analyses may be used, such as regression analysis, discriminant analysis or other multivariate techniques.

4.1.5 Organization and Responsibilities of the Survey Evaluation Team

Dr. John Daigle and his students at the University of Maine will be primarily responsible for planning, executing, and analyzing the customer satisfaction surveys. From September 2000 through December 2001, a graduate student under Prof. Daigle's direction will serve as the on-site evaluator and that student will be assisted by undergraduate students in data collection activities as needed. After data collection ends in September 2001, the survey team will analyze and report the results. Dr. Daigle and the on-site evaluator will have the principal role in working with the local stakeholders and the evaluation team to obtain feedback to refine the evaluation goals, objectives, and measures. He and the on-site evaluator will work with the stakeholders such as Acadia National Park and Downeast Transportation Incorporated to coordinate logistics for contacting tourists and bus users. They will then work with the rest of the evaluation team, under the direction of Dr. Zimmerman, to develop a data collection and analysis approach that is technically sound and achievable within the time and budget constraints.

4.2 Personal Interviews and Focus Groups

Information will be collected using qualitative interviews of Island Explorer bus drivers, Acadia National Park rangers, and managers of both organizations. The purpose of this research evaluation phase is to develop an in-depth understanding of the benefits of different ITS technologies that may have an effect on Island Explorer bus drivers, Island Explorer operations, and interagency relationships.

A semi-structured interview protocol will be developed to guide the conduct of interviews or focus groups. This type of interview has four characteristics: 1) it takes place with respondents known to have been involved in a particular experience; 2) it refers to situations that have been analyzed prior to the interview; 3) it proceeds on the basis of an interview guide specifying topics related to the research hypotheses; and 4) it is focused on the subject's experiences. A purposive sampling strategy will be employed to select information-rich cases whose study will illuminate the questions under study. The logic and power of this technique is that it focuses on individuals who have knowledge about issues of central importance to the purpose of the research.

One of the research evaluation objectives for conducting interviews with Downeast Transportation is to gain an understanding of satisfaction with ITS technologies for the benefits they provide to bus operations, such as managing drivers, planning bus routes, and responding to emergencies. The research evaluation team with feedback from stakeholders will develop an interview guide with questions to minimize dichotomous responses such as "yes" or "no". Pre-testing the instrument will enable the research team to consider additional "probing questions" to elicit greater detail from the interviews and provide the interviewer familiarity with and confidence in the interview guide.

The interview protocol will contain a cover sheet to identify the name of the respondent, date and starting time/ending time of the interview. Also, the cover sheet will list information to discuss with the respondent before asking specific questions related to their use of ITS technologies. In general, the following sequence of events will occur upon arrival: 1) introduction of the interviewer and confirmation of the subject to be interviewed; 2) selecting a location in which to conduct the interview (preferably where it will be quiet and where both the interviewer and subject can sit comfortably); 3) introduction of professional affiliation of being a student at the University of Maine; 4) purpose of the study to assess the benefits from the ITS technologies; 5) how the information will be used and shared with other such as transportation providers and national parks; 6) a summary of types of questions the interviewer will be exploring; and 7) assurance of confidentiality; and 8) permission to tape record the interview. The primary reason for taping interviews is to facilitate the transcribing process. The transcribed files will be used for a computer-assisted analysis of text based, narrative data. These programs will enable the researcher to code, recode, and sort data files into analytic categories for interpretation.

4.3 System Data

Some of the ITS components are capable of generating data records that can be used in the evaluation. The evaluation team will work with the ITS project team to obtain reports directly from the computer systems or other recording devices associated with ITS equipment deployed at ANP and MDI. Data derived from these systems, such as passenger counts, can be used to directly measure the performance of the Island Explorer. For other equipment, data may not be pulled directly, however. For example, if ANP headquarters officials have an accurate location of all ranger units based on the Automated Ranger Vehicle Geo-location System, they can make the optimal assignment for an emergency call, thereby minimizing response time. This would not be reflected in data provided by the Automated Ranger Vehicle Geo-location System itself, but the measure would appear as an improved response time derived from ANP logs.

System data will be obtained from the following ITS components:

- TIS Web log
- TIS interactive telephone service
- Parking lot monitor
- Park entrance traffic volume monitor

- Automatic passenger counter

Presented below are details on specific system data.

4.3.1 Traveler Information Web Log

This web site will monitor and track usage to capture characteristics of visitor profiles, i.e. where visitor is from, which pages accessed, duration of session, and information requested. This system component will be available for the 2001 tourist season.

1. Description: counts of "hits" to web, track of pages visited
2. Sample: data tracked in database, select variables
3. Data items: origin (on Internet) of visitor, pages accessed, duration of session, information requested
4. Data collection Period: beginning 2001
5. Analysis: visitor profile, requests for IE information
6. Responsibilities: Battelle will coordinate with HQ ANP system administration for metrics

4.3.2 Traveler Information Interactive Telephone Service Log

This component will provide information to callers about events and conditions at ANP. It will ring through to live operators when they are available, automatically answer if live operators are not available, provide voice and touch capability, handle at least 24 incoming calls per line, and allow for up to 20 minutes of recorded messages.

1. Description: numbers of callers requesting information
2. Sample: Data will be tracked in a database that can be queried
3. Data items: numbers of callers, menu choices, duration of call, live operator requests
4. Data collection Period: beginning 2001
5. Analysis: numbers of calls, time-based calling patterns, requests for IE information
6. Responsibilities: Battelle will coordinate with HQ ANP system administration for metrics

4.3.3 Parking Lot Monitor

This component of the ITS system consists of a sensor that automatically records vehicles entering and exiting the parking lot and a slow scan video camera that provides real time imagery of the parking lot. These components will be installed in approximately six lots beginning in 2001.

1. Description: continuous car counts that can be aggregated into a specific granularity (cars entering per 15 minutes, cars leaving per hour)
2. Sample: data available according to selection criteria (i.e., 10 August, 1-7PM)
3. Data items: number of cars entering and exiting
4. Data collection period: beginning 2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: Battelle will coordinate with ANP staff to gather data

4.3.4 Park Entrance Traffic Volume Monitor

This component will automatically record the number of vehicles entering or exiting ANP at one of three locations. These data will be available dynamically, and will also be stored. The entrance monitors will be operational in 2001.

1. Description: continuous car counts that can be aggregated into a specific granularity (cars entering per 15 minutes, cars leaving per hour, number of cars per week)
2. Sample: data available according to selection criteria (e.g., 10 August, 1-7PM)
3. Data items: number of cars entering and exiting
4. Data collection period: beginning 2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: Battelle will coordinate with ANP staff to gather data

4.3.5 Automated Passenger Counter

This component of the ITS system consists of a sensor that automatically records the number of passengers boarding the Island Explorer buses. These components will be installed on all IE buses beginning in 2001.

1. Description: continuous passenger counts that can be aggregated into a specific granularity (e.g., number of passengers per bus, per route, per day)
2. Sample: data available according to selection criteria (e.g., 10 August)
3. Data items: number of passengers boarding a bus
4. Data collection period: beginning 2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: Battelle will obtain data from Tom Crikelear

4.4 Agency Data

Another source of data that can be tapped for evaluation purposes are records produced by government agencies or other ITS project team members, in particular the Island Explorer. The evaluation team will obtain copies of records and analyze the information they contain that is pertinent to the ITS evaluation.

Historical data is data that has been collected by organizations that have a vested interest in certain measures. Examples of this are sales tax revenues, traffic accidents, or number of ANP visitors. These data are of interest to an ITS deployment in that they can show changes in visitor behavior over the period of deployment. The data considered have been linked to a hypothesis, which in turn supports a goal area for the deployment. Below is a table of historical data that will be evaluated.

4.4.1 Island Explorer Driver Logs

The Island Explorer driver logs are completed each shift. They record the driver's name, bus number, start time, and data elements listed below. The data is then entered into a database for route analysis.

1. Description: paper logs that are entered into an Excel database
2. Sample: data available by one hour, day, week, and month increments
3. Data items: routes, stops, times, passenger counts, standing riders, service denials

4. Data collection period: Island Explorer operating season 1999, 2000, 2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: data available upon request, Battelle will coordinate with Tom Crikelair

4.4.2 Downeast Transportation Incorporated (DTI) Operations Records

DTI, the operator of the Island Explorer, maintains operating records in manual form. DTI records the pertinent business information necessary to reflect the operating efficiency of the Island Explorer.

1. Description: manual records of operating and administrative measures
2. Sample: manual selection of data
3. Data items: driver hours, payroll, routes run, miles driven, vehicles operated, repair costs, missed connections, schedule adherence, missed runs
4. Data collection period: beginning 1999 through 2001
5. Analysis: analyze numbers to determine pre- and post-ITS operating efficiency
6. Responsibilities: Battelle will coordinate with DTI staff to gather data

4.4.3 Maine Department of Transportation Vehicle Counts

Traffic counts are provided by a permanent counter installed at the State Route 3 Bridge in Trenton. Counting is continuous and performed 365 days per year.

1. Description: sensor counts performed continuously at Thompson Island Bridge on State Route 3.
2. Sample: data available by one hour, day, week, and month increments
3. Data items: vehicles eastbound, vehicles westbound
4. Data collection period: 365 days, 1999-2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: data available upon request, Battelle will coordinate with Maine DOT

4.4.4 Maine Department of Transportation Accident Data

All accidents resulting in personal injury or damage over $1,000 that occur on a public road are reportable to the Maine DOT using a prescribed format. These data is stored in a standard format that is compatible with national standards.

1. Description: numbers of traffic accidents involving a motor vehicle with personal injury and/or damage over $1000. Available by day, month, and year, and according to specific stretches of road, weather condition, time of day
2. Sample: data can be selected to coincide with IE operations
3. Data items: type of motor vehicle, pedestrian, bicycle, weather, road surface, speed
4. Data collection period: data collected continuously prior to 1999 and through present
5. Analysis: by specifying specific routes during specific times, a change in accident rates can be analyzed
6. Responsibilities: Battelle will coordinate with Maine DOT to request accident parameters specifying specific nodes

4.4.5 Maine Department of Revenue Tax Receipts

These data source records the amounts of sales tax collected in specific towns and counties by quarter. It is a reliable and verifiable indicator of economic activity.

1. Description: summary of taxable sales and taxes collected by town and county per quarter
2. Sample: total dollars per town per quarter, granularity of business operating, building supply, food store, general merchandise, other retail, automobile & transportation, restaurant and lodging.
3. Data items: total dollars by category by political designation
4. Data collection period: continuously by quarter before 1999 through 2001
5. Analysis: analysis of trends, changes in specific categories
6. Responsibilities: Battelle will contact Maine DOR for summary reports

4.4.6 Maine Department of Environmental Protection Emissions Modeling

The Maine DEP runs models based on sensor readings collected from three locations on Mount Desert Island. These data are collected hourly, year round, and are reported to the US EPA.

1. Description: computer model run using inputs from specified monitoring stations and parameters such as volume and modal split of travel
2. Sample: data are available electronically in one hour increments
3. Data items: measurement of ozone, nitrogen oxide, carbon monoxide, volatile organic compounds, acid rain, mercury, particulate, dry deposition
4. Data collection period: continuously prior to 1999 through 2001
5. Analysis: analysis of levels of pollution using DEP models, analysis of avoided levels of pollution using offset models from Island Explorer ridership numbers, carless visitors
6. Responsibilities: Battelle will coordinate with Maine DEP for data acquisition and modeling

4.4.7 Acadia National Park Records

Three types of data for the evaluation will be obtained from records already kept by Acadia National Park. These include financial records, logs made by Park Rangers, and logs of visitor attendance, each of which is described below.

ANP Financial Records. These documents record the entrance fees and donations made by visitors to ANP.

1. Description: Summary amounts of gate fees and donations
2. Sample: Data is available
3. Data items: dollar amounts of gate fees and donations
4. Data collection Period: continuously prior to 1999 through 2001
5. Analysis: Differences in entrance fees collected as a percentage of park attendance will measure the efficacy of TIS messages
6. Responsibilities: Battelle will coordinate with HQ ANP for data

Ranger Logs. Ranger logs are maintained in the Ranger Office. They are completed at the end of each shift by the departing rangers, and are referred to by arriving personnel to acquaint themselves with the

current situations in the Park. Records are entered into the CIRS, and maintained by the NPS in Denver, Colorado.

1. Description: paper logs filled out by rangers and dispatchers, later entered into the Case Incident Reporting System (CIRS)
2. Sample: granularity of ranger, day, month, year, type of incident
3. Data items: traffic violations, searches, rescues, ad hoc incidents
4. Data collection period: continuously prior to 1999 through 2001
5. Analysis: analyze trends and discrete counts of accidents, response to incidents
6. Responsibilities: Battelle will coordinate with ANP (Denver/Acadia) to obtain specific data

ANP Visitor Logs (attendance). These records are maintained by the National Park System to record attendance at parks. An occupancy factor is applied to each motor vehicle (car). Other vehicles, such as tour buses, have occupancy computed by the level of entrance fee paid.

1. Description: continuous car counts that can be aggregated into a specific granularity (cars entering per hour, cars leaving per hour, number of cars per week)
2. Sample: data available according to selection criteria (i.e., 10 August, 1-7PM)
3. Data items: number of cars entering and exiting ANP by one of three roads
4. Data collection period: continuous pre-1999 to 2001
5. Analysis: analyze numbers to determine peaks, trends; select analysis of specific events
6. Responsibilities: Battelle will coordinate with ANP staff to gather data

4.5 Direct Observation

Visitors to Acadia National Park often resort to illegal parking when official parking lots are full. As the Park Service does not regularly keep data on illegal parking, the Battelle Team will measure the behavior through direct observation. A member of the data collection crew will be assigned to observe and record the number of cars parked illegally on selected days, times, and locations.

1. Description: sample of car counts that can be aggregated by location or other criteria
2. Sample: ANP locations known for frequent illegal parking, sample by day of week and time of day. Coordinate sampling design with other measures where desirable, such as posting of TIS messages about full parking lots, so that impact of ITS can be correlated.
3. Data items: number cars parked
4. Data collection period: baseline summer 2000; post-ITS deployment summer of 2001
5. Analysis: standard statistical analyses will be used for trends and before/after comparisons.
6. Responsibilities: Battelle will design sample and collect data. Logistics will be coordinated with ANP staff.

5.0 Management of the Evaluation Activities

This section discusses the organizational structure established for management of the evaluation and the schedule of milestones and deliverables.

5.1 Organizational Structure

Figure 2 shows the organizational structure of the evaluation team for the Acadia National Park ITS Field Operational Test. Under contract to U.S. DOT, Battelle Memorial Institute with support from University of Maine is responsible for conducting the evaluation. However, the evaluation will not be possible without the cooperation and involvement of many other parties, including:

- Acadia ITS FOT Project Team--Stakeholders and SAIC
- IE Explorer Management and Drivers
- Acadia National Park Staff
- Visitors to ANP and MDI
- Tourism Businesses on MDI
- Other Government Agencies.

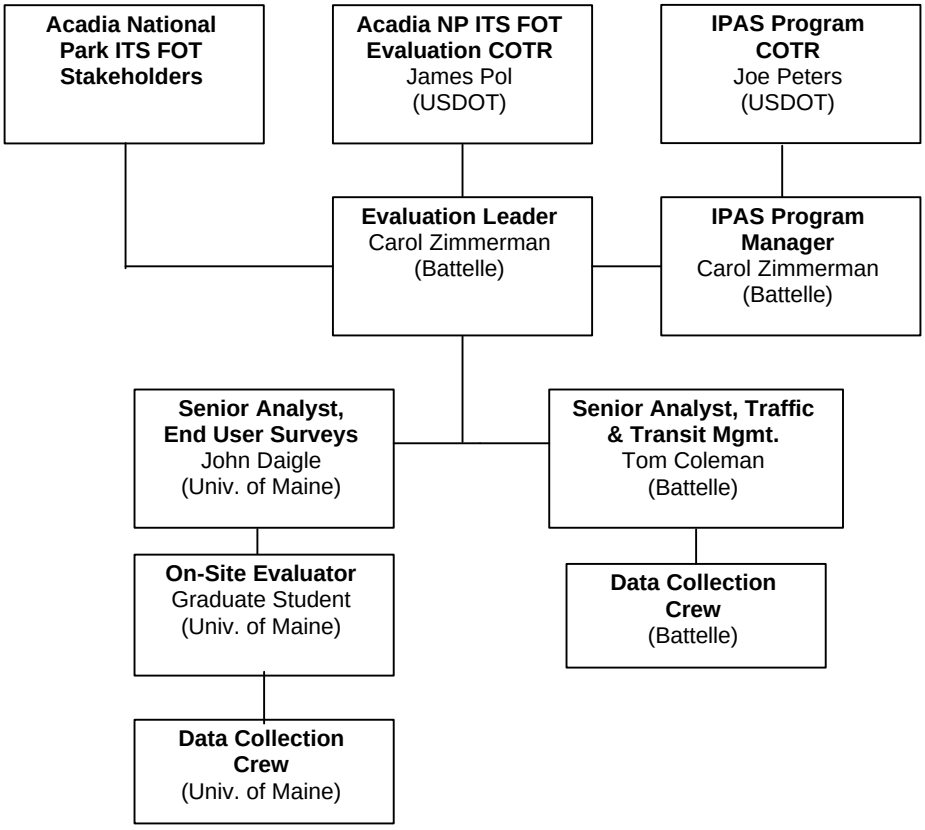

Figure 2. Evaluation Team for Acadia National Park ITS Field Operational Test

The ITS FOT stakeholders have a special role in that they are actively involved in working with the Battelle Team to define the goals of the evaluation and the measures that will be used to assess the impact of ITS. Implementing the evaluation plan also requires access to sites and personnel so that data can be collected, and several of the parties listed above will need to provide such access. Table 10 presents the roles and responsibilities of parties involved in the data collection stage of the evaluation.

Table 10. Roles in the Data Collection Stage of the Evaluation

Party	Role	Key Points of Contact
Battelle	Plan and implement data collection	Carol Zimmerman Tom Coleman John Daigle
Acadia National Park	• Provide ANP records • Facilitate access to ANP sites for visitor surveys • Participate in interviews of managers and rangers	Len Bobinchock
DTI/Island Explorer	• Provide IE records • Facilitate access to IE buses for visitor surveys • Participate in interviews of managers and drivers	Tom Crikelair
Maine DOT	Provide agency records	Russ Charrette
Maine DOR	Provide agency records	Jerry Stanhope
Maine DEP	Provide agency modeling results	Bryce Sproul
SAIC	• Provide ITS component details • Facilitate collection of system data	Moe Zarean David Register

5.2 Schedule

The evaluation of the Acadia National Park ITS FOT started in May 2000 and is scheduled to be completed in December 2001. Evaluation milestones and deliverables during that timeframe are shown in Table 11. By necessity, evaluation activities are tied closely to the seasonal cycle of tourism on Mount Desert Island. While much of the data collection will be focused during the summer months, the rest of the calendar will be used for other evaluation activities such as planning, analysis, and report writing.

Data collection is scheduled for the summers of 2000 and 2001 and is dependent to a large extent on the limited operating season of the Island Explorer, which runs from late June through early September during the height of the tourist season.

Table 11. Schedule of Milestones and Deliverables

TASK	2000								2001											
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Evaluation Strategy		?																		
Evaluation Plan			?																	
Detailed Test Plans				?								?								
Baseline Data Collected						?														
Report on Baseline Conditions									?											
Updated Evaluation Plan (if needed)													?							
Updated Detailed Test Plan (if needed)														?						
Post-Deployment Data Collected																	?			
Draft Evaluation Report																		?		
Final Evaluation Report																				?
Archived Data																				?

6.0 Next Steps

Several detailed test plans will be developed as specified in the evaluation plan. The test plans are the protocols that will guide the actual data collection and analysis. With respect to a visitor survey, the individual test plan would include the questionnaire to be used, the sample design, tabulation scheme for the data, individuals or organizations responsible for conducting the test, and other details needed to implement the survey. Preparation of the detailed test plans will be scheduled based on the availability of the information on the operation of the ITS components and the availability of resources in the Battelle evaluation team. For example, because the post-deployment survey of visitors will take place during the summer 2001, it will be most advantageous to develop the questionnaire in early 2001 when all operational details on the ITS deployment are available.

During the summer of 2000, baseline data will be collected from either existing sources or newly collected by the Battelle Team and/or project team stakeholders. During the fall and winter of 2000/2001, the Battelle Team will analyze the baseline data. The detailed test plans will continue to be developed or refined to reflect any adjustments that might be made in the deployment of the ITS components prior to the operational phase in the summer of 2001.